SECTION C Descriptions and Specifications

MARINE CORROSION AND ENVIRONMENTAL TESTING OF NAVAL MATERIALS AND MACHINERY AND PIPING SYSTEMS

1.0 BACKGROUND INFORMATION

The Naval Surface Warfare Center, Carderock Division (NSWCCD) undertakes a wide range of research, development, test and evaluation (RDT&E) programs in the areas of marine corrosion and environmental degradation of materials used in Naval ship hull, propulsor, machinery and piping system applications. The materials of interest include both ferrous and non-ferrous metals and alloys, as well as metallic, ceramic and organic coating systems applied over metallic substrates and advanced composites. In addition, NSWCCD conducts programs to evaluate the effects of seawater and the environment on the operational capabilities of naval shipboard machinery and piping systems and components. Thus, there is a continuous need for a marine testing facility to conduct these RDT&E programs. This test facility must provide unpolluted seawater having chemical and physical properties similar to those expected in the open ocean where naval ships and their equipment typically operate. This facility must also have the flexibility to modify the test environment as necessary to simulate other required environmental conditions, such as varying the salinity, temperature, oxygen or sulfide content and providing chlorinated water for testing purposes. Furthermore, the site must have the necessary utilities, equipment and manpower for the set-up and operation of both short and long term corrosion and environmental test programs involving Naval materials and machinery components. This Statement of Work addresses the detailed requirements for such a facility and the nature of the work to be accomplished there.

2.0 STATEMENT OF WORK

2.1 Scope of Work

The contractor shall have and maintain the facilities capable of meeting the following requirements:

2.1.1 The contractor shall provide a seawater test site adjacent to a source of natural, fresh, unpolluted ocean water (seawater), and atmospheric corrosion test site (providing a seacoast air exposure) facilities. The contractor shall provide marine corrosion services, equipment, utilities, and personnel for conducting seawater corrosion, marine atmospheric corrosion, and other environmental testing of metals, composites, naval machinery and piping systems and components as detailed in the subsequent sections of this Statement of Work (SOW).

2.1.2 Contractor personnel shall provide engineering services to assist NSWCCD technical investigators in optimizing test design, planning, execution and data analysis.

2.1.3 The contractor shall be able to assist in the preparation of meetings and/or conferences where results of programs undertaken during the term of this contract can be presented to other government and/or private industry and academic personnel, as applicable.

2.2 Testing and Data Acquisition Requirements

2.2.1 At the test sites specified in Section 2.1.1, the contractor shall conduct all of the following types of Navy testing in order to generate required data:

2.2.1.1 **Seawater Tests**

(1) seawater immersion
(2) seawater splash and spray
(3) alternate immersion
(4) erosion, jet impingement and cavitation
(5) crevice corrosion
(6) galvanic corrosion
(7) electrochemical testing

Specific examples of seawater immersion, jet impingement and crevice corrosion test programs are presented in Attachment (A) to this SOW.

2.2.1.2 **Marine Atmospheric Exposure Tests**

(1) general corrosion
(2) localized corrosion, i.e., pitting, crevice, exfoliation
(3) galvanic corrosion

A specific example of an atmospheric exposure test program is presented in Attachment (A) to this SOW.

2.2.1.3 **Mechanically Stressed Corrosion Testing**

(1) corrosion fatigue
(2) environmentally assisted (EAC) and sustained load cracking (SLC) and hydrogen embrittlement

Specific examples of corrosion fatigue and EAC/SLC test programs are presented in Attachment (A) to this SOW.

2.2.1.4 **Naval Machinery and Piping System/Component Testing**

Testing shall include, but not be limited to, such equipment as: seawater pumps, seawater heat exchangers, seawater fouling control systems and devices, desalination systems, and piping systems and components.

Specific examples of reverse osmosis desalination, seawater heat exchanger, chlorination/dechlorination and pump and piping test programs are presented in Attachment (A) to this SOW.

2.2.3 **Set-up, Operation and Maintenance of Test Equipment**

2.2.3.1 **Equipment and Instrumentation Set-up**

Set-up equipment and instrumentation necessary to implement a NSWCCD test program shall include, but not be limited to, the following:

(1) construction of wood and metal test stands for equipment and instrumentation mounting;
(2) assembly of necessary piping and fittings to and from centralized source of seawater and freshwater;
(3) wiring of electrical connections to instruments, motors, etc.;
(4) installation, calibration and checkout of standard instrumentation for seawater and marine environmental testing, as well as data acquisition equipment such a computers for monitoring and recording data;

(5) preparation of test specimens or panels used in seawater corrosion, atmospheric exposures, electrochemical corrosion, and mechanical-corrosion testing.

2.2.3.2 **Installation of Components/Parts**

Provide and install necessary components/parts for test set-ups including, but not limited to, the following:

(1) pumps, motors, controllers, flow and pressure monitoring devices together with spare parts for these items;
(2) valves, fittings, piping, and other piping components as needed for test system assembly;
(3) electrical conduit, transformers, power conditioning equipment, switch boxes, motor starters, heaters, relays and other electrical components as needed;
(4) materials such as lumber, nails, screws, and similar items;

2.2.3.3 **Operation of Tests and Maintenance of Test Equipment/Facilities**

2.2.3.3.1 **Operation of Tests**

(1) Operate the test equipment, instrumentation, and data acquisition equipment during the course of corrosion and marine machinery testing in order to accumulate the necessary test data.
(2) Continuous watch standers or intermittent data takers shall be available, as required, during normal daytime operation for weekdays (Monday through Friday).
(3) Intermittent personnel monitoring shall be provided during night hours and weekends to record pertinent readings and assure correct test system functioning. On occasion, full-time watchstanders may be requested during evening hours and on weekends.

2.2.3.3.2 **Routine and Emergency Maintenance of Test Equipment and Facilities**

(1) **Routine** maintenance of equipment and facilities shall be performed by the contractor, including, but not limited to, the following: the changing of pump seals; clearance of blockages in seawater lines; changing and cleaning of filters; routine replacement of parts; oiling and greasing of machines; general care of equipment and facilities.

(2) For **Emergency** maintenance of the equipment, the contractor shall have the ability to: plan "quick response" procedures; and fabricate small special metal or plastic parts, as necessary, in order to effectuate a quick repair of equipment undergoing testing.

2.2.4 **Data Acquisition, Recording and Reduction for Ongoing Testing**

2.2.4.1 **Data Acquisition**

(1) Obtain the following types of data **daily** with regard to corrosion and marine machinery system testing: temperatures; amperages; voltages; pressures; liquid flow rate; specimen rotational speeds; pH; titrations for chlorine and chloride concentration; analysis for total dissolved solids; liquid electrical conductivity; dissolved oxygen measurement; and other measurements considered standard for marine corrosion and marine machinery components testing.
(2) On an intermittent basis, perform tests or measurements to verify physical or metallurgical changes undergone by components or corrosion specimens as a result of seawater corrosion or atmospheric exposure.
(3) Perform other types of chemical and biological analyses on a quick turnaround basis (one or two days).

2.2.4.2 **Data Recording and Reduction**

(1) Data obtained from operating tests shall be recorded manually on log sheets and/or entered directly into a data acquisition system supplied with the machinery system or entered into an acquisition system owned by the contractor.

(2) Manually logged data shall be subsequently entered into a computer spreadsheet by the contractor for further reduction either by the contractor or by the Government.

2.3 NSWC Access to Test Site

2.3.1 Access to the test site shall be made available during normal weekday working hours, and, as necessary, on a 24-hour a day basis or during weekends, in order for Navy employees to inspect, operate (if necessary) and monitor test set-ups and ongoing testing. These visits will normally be prearranged for mutual convenience.

2.3.2 NSWCCD may, as the situation requires, have Navy employees work independently of contractor personnel at the contractor's site to install specific test apparatus and systems and to collect and analyze data.

(1) To the extent possible, details of such arrangements will be provided in the individual statements of work set forth in each delivery order.

(2) Under these conditions, the contractor may be requested to assist the government in order to ensure timely accomplishment of various phases of the individual tasks, ranging from test set-up and initiation to operation and monitoring and test termination and system disassembly.

2.4 Government Furnished Equipment (GFE) and Government Owned Property

Specified elsewhere herein.

2.5 Security Requirements

During the performance of this contract, the contractor may be required to have access to and may be required to receive, generate and store information classified to the level of **SECRET** as indicated on the DD Form 254 – Contract Security Classification Specification, Attachment (D). Therefore, all contractor facilities and personnel used in support of this contract shall have a security clearance at the **SECRET** level.

All deliverables associated with this Statement of Work are "Unclassified" unless otherwise specified on the individual delivery orders. Individual delivery orders shall specify the security requirement.

2.6 Technical and Financial Reporting

Technical and financial data as specified on the DD Form 1423 – Contract Data Requirements List, Attachment (E) and the DD Form 1664 – Data Item Description, Attachment (F), or as specified under individual delivery orders.

2.6.1 **Technical Reports**

(1) Hydrology parameters shall be measured and the results reported in writing on a monthly basis over the duration of the contract in accordance with A001 of the DD Form 1423. Required guidelines for conducting element/substance analyses for these hydrologies are presented in Attachment (A), with the exception of the procedure for the determination of SULFIDE content, which is given in Attachment (B).

(2) Upon completion, or as otherwise required, for each separately delineated corrosion data compilation or system/component test analysis, the Contractor shall furnish reports in accordance with A002 of the DD Form 1423 detailing the work performed under a delivery order. Items to be contained in these reports include, but are not limited to: environmental test conditions; design and operation information for unique test systems; test data; specimen photographs; a list of completed test specimens; and, where required, metallographic and SEM evaluations.

2.6.2 **Financial Reports**

(1) The Contractor shall submit financial summaries in accordance with A003 of the DD Form 1423. The report will include a complete financial breakdown by individual task, to include: a breakdown of monthly expenditures over the duration of the task; task award amount; task funded amount to date; available funded balance; type of funding utilized (RDTE, OMN, etc.); task award date; and projected task completion date. Additionally, the report will include: the total contract award amount (ceiling); total dollar amount of tasks awarded to date; remaining ceiling dollar amount; total funding of tasks; total expenditures on all tasks; and the balance of funding currently available.

(2) Reports are to be provided both electronically and in hard copy to the contract COR.

2.7 Personnel

The contractor is required to provide personnel with education and experience levels in the following labor categories. Indivudials approved as key personnel under this contract are identified in Section I, clause entitled Substitution or Addition of Key Personnel. During performance of the contract, the contractor is required to request in writing to the Contracting Officer, any substitutions or additions to key personnel in accordance with the above clause.

2.7.1 **Key Personnel**

(1) **Principal Investigator/Task Manager** (1) resume - Shall have a Bachelor of Science degree in technical field related to corrosion testing and five (5) years experience in the management of programs concerning testing areas addressed in Section C, OR have ten (10) years experience in the technical development and management of programs concerning testing areas addressed in Section C. Shall have experience in supervising all phases of the project tasks and have the ability to establish and meet project needs with regard to technical and non-technical manpower, facilities, and equipment. Shall have experience in the planning and supervision of the set up of the test equipment and related instrumentation in conducting of tests on a daily basis. Shall have experience in reviewing test data to ensure that the program is running satisfactorily

(2) **Associate Investigator** (1) resume - Shall have eight (8) years experience as a marine corrosion technologist, including four (4) years in responsible charge. Shall have seawater corrosion background and experience necessary for providing on-site guidance on issues regarding corrosion and materials failures during testing. Shall have experience in the set-up and conduct of separate corrosion or materials tests associated with a particular program. Shall have experience in the review and coordination of all corrosion testing conducted as part of an individual project.

2.7.2 **Non-Key Personnel** - No resumes required

Engineering Technician (5) people - Shall have the ability to perform assignments that are not completely standardized or prescribed. Shall have the ability to select or adapt standard procedures or equipment, using fully applicable precedents. Shall have the ability to receive initial instructions, equipment requirements, and advice from supervisor or engineer as needed. Shall have the ability to perform recurring work independently; work is reviewed for technical adequacy or conformity with instructions. Shall have the ability to perform at this level one or a combination of such typical duties as:

Set up instrumentation and data acquisition equipment in accordance with Section C - Statement of Work, section 2.2.3.1.1, items (1) through (5). Conduct on-site water chemistry analyses and other laboratory chemical and metallurgical tests as necessary to complete a test program. Construct components, subunits, or simple models or adapts standard equipment. May troubleshoot and correct malfunctions. Follow specific layout and scientific diagrams to construct and package simple devices and subunits of equipment. Conduct various tests or experiments which may require minor modifications in test setups or procedures as well as subjective judgments in measurement; select, set up, and operate standard test equipment and record test data. Extract and compile a variety of engineering data from field notes, manuals, lab reports, etc.; processes data, identifying errors or inconsistencies; select methods of data presentation. Assist in design modification by compiling data related to design, specifications, and materials which are pertinent to specific items of equipment or component parts. Develop information concerning previous operational failures and modifications. Use judgment and initiative to recognize inconsistencies or gaps in data and seek sources to clarify information.